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Clinical significance of mild thrombocytopenia in cesarean sections: An underestimated risk factor

Seyma Banu Arslanca
Department of Perinatology, Etlik City Hospital, Ankara, Turkey

Abstract

Aim: Mild thrombocytopenia, a commonly overlooked condition, may significantly influence clinical outcomes during cesarean sections, with potential implications for blood transfusion needs, intravenous iron therapy, and postoperative hemoglobin levels.

Material and Methods: This retrospective cohort study was conducted on pregnant women undergoing cesarean sections at a tertiary healthcare center from January 2021 to December 2022. The participants were divided into normal platelet (n:636) and mild thrombocytopenia (n:435). Data were collected on demographic and anthropometric variables, obstetric and medical history, preoperative-postoperative laboratory values, and operative details.

Results: Postoperative complications were more prevalent in the mild thrombocytopenia group (14.3% vs. 3.5%, p=0.001). Mild thrombocytopenia was associated with higher pre- and post-treatment hemoglobin levels (12.2±1.5 g/dL vs. 11.7±1.3 g/dL, p=0.001, and 10.1±1.5 g/dL vs. 9.9±1.4 g/dL, p=0.026, respectively). The rate of individuals with a decline in hemoglobin levels of ≥3 g/dL was higher in the mild thrombocytopenia group (25.3% vs. 10.7%, p=0.001). Independent predictors of outcomes included cesarean section in the last delivery (OR 2.96, p=0.003), presence of postoperative complications (OR 0.676, p=0.012), lower preoperative hemoglobin levels (OR 0.175, p<0.001), and increased gestational week (OR 1.219, p=0.014).

Discussion: Mild thrombocytopenia was associated with higher preoperative and postoperative hemoglobin levels and its substantial drop. The evident correlation with postoperative complications and the potential influence on blood transfusion demands necessitate a paradigm shift in its clinical perception and management of cesarean sections.

Keywords

Mild Thrombocytopenia, Cesarean Section, Hemoglobin, Blood Transfusion

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Corresponding Author: Seyma Banu Arslanca, Department of Perinatology, Etlik City Hospital, 06170, Ankara, Turkey.
E-mail: dr.banubozkurt@hotmail.com P: +90 532 253 80 13
Corresponding Author ORCID ID: https://orcid.org/0000-0003-2494-3372
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Introduction

Platelets, small cellular fragments that are pivotal in hemostasis, have consistently been central to our understanding of coagulation and thrombotic processes [1]. A deficiency in the average count of these components, a condition termed thrombocytopenia, is typically categorized into three levels of severity: mild, moderate, and severe [2]. Over the years, the medical community has devoted considerable attention to exploring the health implications and management strategies associated with moderate and severe thrombocytopenia, given their more immediate and potentially drastic consequences [3]. However, this focus has often led to a close oversight of the mild variant of this condition in clinical research and practice [4].

In obstetrics, this neglect may have significant repercussions, particularly in cesarean sections [5]. An optimal platelet count is vital in surgical procedures to prevent hemorrhagic complications [6]. Thus even a mild deficit in platelet numbers could significantly sway clinical outcomes [7]. Specifically, mild thrombocytopenia could increase the requirement for ancillary medical interventions such as blood transfusions and intravenous iron treatments or indicate a more substantial decrease in hemoglobin in the postoperative period, potentially surpassing a drop of three units in the complete blood count [7,8]. Contrary to the prevailing trend of downplaying its significance, our hypothesis challenges this status quo [9]. We posit that mild thrombocytopenia is not a minor concern to be glossed over but may play a pivotal role in the management of cesarean section patients [5,10]. We postulate an intricate connection between this frequently overlooked condition, an escalated need for blood transfusions and IV iron therapy, and a more significant decrease in postoperative hemoglobin [11].

The primary objective of the study is to direct the clinical spotlight toward the under-explored domain of mild thrombocytopenia on the management of deliveries. We believe that this endeavor will contribute to understanding the results of mild thrombocytopenia and developing more individualized care strategies for blood transfusion and improve overall health outcomes for women undergoing cesarean sections.

Material and Methods

Study Design

This study was conceived as a retrospective cohort study to assess the clinical implications of mild thrombocytopenia in women undergoing cesarean sections. All data were derived from the Obstetrics and Gynecology Department of our hospital, a tertiary healthcare center equipped with medical facilities and handling many cesarean section procedures annually.

Ethical Statement

The Institutional Review Board approved all study protocols of the hospital (Approval date: 17/07/2021- ID: 09/15), and we ensured strict adherence to the principles of the Declaration of Helsinki and its later amendments. Although informed consent was not required due to the study's retrospective nature, all patient data were anonymized to protect privacy and maintain data integrity. The study team committed to upholding the highest standards of ethical considerations throughout the research process.

Study Population & Sample Selection

The study population included all pregnant women who underwent cesarean sections at our institution during the defined study period between January 2021 and December 2022. To enhance the robustness of our results, several exclusion criteria were applied. Patients with pre-existing hematological disorders, those with chronic diseases known to influence platelet count or function, and patients who received medication or underwent procedures that could potentially alter the platelet count or function were excluded from the study.

A comprehensive review of medical records was undertaken to collect the necessary data. The following parameters were: demographic and anthropometric variables, including age, height, weight, BMI, and weight gain during pregnancy; obstetric history, including gravidity, parity, number of abortions, number of living children, type of previous deliveries (cesarean section or vaginal delivery), number of cesarean sections, number of regular vaginal deliveries; medical history including existing medical conditions, current medications, smoking status; obstetric complications including the presence of complications such as preeclampsia, gestational diabetes, polyhydramnios or oligohydramnios; preoperative-post operative laboratory values including hemoglobin, hematocrit, platelet count; blood transfusion and operative details. Operative details were recorded, including the type of anesthesia used, the duration of surgery, intraoperative blood loss, and any intraoperative complications. We collected complete blood count results preoperatively and postoperatively.

Outcome Measures

Our study was principally concerned with three primary outcome measures. These were the need for blood transfusion during or after surgery, the requirement for intravenous iron therapy in the postoperative period, and a substantial drop in postoperative hemoglobin levels, defined as a decrease in complete blood count within 48 hours of the cesarean section.

Statistical Analysis

The collected data were analyzed using advanced statistical software SPSS version 23 (SPSS Inc., Chicago, IL, USA). The G-Power v3 program performed the post-hoc power of the study where α error probability, effect size, and the power of the study were 0.05, 0.10, and 0.99, respectively. A p-value less than 0.05 was considered statistically significant. Continuous variables were represented as mean ± standard deviation if normally distributed or median with interquartile range for non-normally distributed data. Categorical variables were expressed as frequencies and percentages. As appropriate, a comparative analysis was performed using Chi-square or Fisher's exact test for categorical variables and independent t-test or Mann-Whitney U test for continuous variables. We performed a multivariate logistic regression analysis to identify independent predictors of the outcomes.

Ethical Approval

Ethics Committee approval for the study was obtained.

Results

Demographic Comparison

In the comparison between individuals with average platelet counts and those with mild thrombocytopenia, age, height,

Body Mass Index (BMI), weight gain, and gestational week were not significantly different between the two groups (p>0.05). Regarding neonatal outcomes, the baby's weight at birth was not different between the two groups (3012.7±649.1 g for normal platelets and 3070.1±654.7 g for mild thrombocytopenia, p=0.155). The proportion of male babies was similar between groups (50.6% vs. 52.9%, p=0.471).

The conception method, precisely the rate of in vitro fertilization (IVF), was also similar between groups (2.2% vs. 2.3%, p=0.916). Interestingly, a difference was noted in the rate of spinal anesthesia (97.6% for normal platelets vs 99.8% for mild thrombocytopenia, p=0.005). The rate of postoperative complications was higher in the mild thrombocytopenia group compared to the normal platelet count (14.3% vs 3.5%, p=0.001). Other factors such as the type of the final delivery (C/S, 53.8% vs. 58.6%, p=0.117), smoking habits (11.2% vs. 12.2%, p=0.613), and the presence of obstetric complications (20% vs. 21.1%, p=0.638) did not differ between the groups. However, the systemic disease was higher in the mild thrombocytopenia group compared to the normal platelet group (9.7% vs 6.1%, p=0.032), as was medication use (6.7% vs. 3.1%, p=0.008). Finally, a significant difference was observed in amniotic fluid status, with a slightly higher proportion of normal level in the normal platelet than mild thrombocytopenia (88.1% vs 86.2%, p=0.004).

Hematological Alterations

In the analysis of hematological parameters between individuals with normal platelet and those with mild thrombocytopenia, the requirement for blood transfusion was not different between the two groups (6.8% vs. 4.8%, p=0.238). When comparing pre-treatment hemoglobin (Pre-Hb) levels, the mild thrombocytopenia had significantly higher levels (12.2±1.5 g/dL) compared to the normal platelet group (11.7±1.3 g/dL) (p=0.001). Similarly, post-treatment hemoglobin (post-Hb) was also slightly higher in mild thrombocytopenia (10.1±1.5 g/dL) than in normal platelet (9.9±1.4 g/dL), and the difference was significant (p=0.026). The change in hemoglobin levels (Delta-Hb) from pre- to post-treatment was more effective in the mild thrombocytopenia group (2.08±1.21 g/dL) compared to the normal platelet group (1.74±0.96 g/dL, p=0.001). Pre-treatment hematocrit (pre-Htc) did not differ between the two groups (35.9±8.6% in normal platelets vs. 36.7±4.1% in mild thrombocytopenia, p=0.071), nor did the post-treatment hematocrit (post-Htc) levels (30.9±10.9% vs 30.6±4.2%, p=0.660). The change in hematocrit (Delta-Hct) from pre- to post-treatment was also not significantly different (5.08±13.4% vs. 6.12±3.7%, p=0.115). However, a significant difference was observed in the proportion of individuals with a decline in hemoglobin levels of ≥3 g/dL, with the mild thrombocytopenia group having a higher rate (25.3% vs. 10.7% in the normal platelet group, p=0.001). A similar trend was observed in those with a decline of ≥4 g/dL; again, the rate was higher in the mild thrombocytopenia (6.2% vs 3.1% in the normal platelet, p=0.011).

Logistic Regression of Blood Transfusion

The forward stepwise logistic regression model highlighted significant predictors for the outcome. Women who had a cesarean section in their last delivery were approximately 2.96

Table 1. Comparative analysis of normal platelet individuals and mild thrombocytopenia.

Variables	Normal Platelet (N:636)	Mild Thrombocytopenia (N:435)	P Value
Age, years	28.2±8.1	29.2±5.8	0.087
Height, cm	160.4±6.1	160.3±6.2	0.790
BMI, kg/m²	29.5±5.1	29.0±4.6	0.112
Weight Gain, kg	10.8±8.5	10.9±5.5	0.930
Delivery Week, weeks	37.8±2.4	37.8±2.3	0.717
Baby Weight, g	3012.7±649.1	3070.1±654.7	0.155
Baby Gender, Male	322 (50.6%)	230 (52.9%)	0.471
Conception, IVF	14 (2.2%)	10 (2.3%)	0.916
Anesthesia, Spinal	621 (97.6%)	434 (99.8%)	0.005
Postop Complication, yes	22 (3.5%)	62 (14.3%)	0.001
Last Delivery Type, C/S	342 (53.8%)	255 (58.6%)	0.117
Systemic Disease, yes	39 (6.1%)	42 (9.7%)	0.032
Medicine Use, yes	20 (3.1%)	29 (6.7%)	0.008
Smoking Habit, yes	71 (11.2%)	53 (12.2%)	0.613
Obstetric Complication, yes	127 (20%)	92 (21.1%)	0.638
Amniotic Fluid, normal	560 (88.1%)	374 (86.2%)	0.004

Abbreviations. "BMI": Body Mass Index, "IVF": In Vitro Fertilization, "C/S": Cesarean Section, Data Analysis. Continuous variables were examined using independent t-tests, presented as means and standard deviations. For the analysis of categorical variables, chi-square was utilized and expressed as counts and %. The threshold of significance was set at a p-value less than 0.05. Subgroups. Data included the gender of the baby (Male or Female), conception (Spontaneous or IVF), and type of anesthesia (General or Spinal). Postoperative complications were cataloged as either present (Yes) or absent (No). The subjects were grouped based on blood group, presence or absence of disease, medication use, smoking habits, and obstetric complication status.

Table 2. Hematological Parameters in normal platelet and mild thrombocytopenia.

Variables	Normal Platelet (N:636)	Mild Thrombocytopenia (N:435)	P Value
Blood Transfusion, yes	43 (6.8%)	21 (4.8%)	0.238
Pre-Hb, g/dL	11.7±1.3	12.2±1.5	0.001
Post-Hb, g/dL	9.9±1.4	10.1±1.5	0.026
Delta-Hb, g/dL	1.74±0.96	2.08±1.21	0.001
Pre-Htc, %	35.9±8.6	36.7±4.1	0.071
Post-Htc, %	30.9±10.9	30.6±4.2	0.660
Delta-Hct, %	5.08±13.4	6.12±3.7	0.115
Hb Decline ≥ 3 g/dL, yes	68 (10.7%)	110 (25.3%)	0.001
Hb Decline ≥ 4 g/dL, yes	19 (3.1%)	27 (6.2%)	0.011

Abbreviations. "Hb": Hemoglobin, "Htc": Hematocrit, "Pre": Before treatment, "Post": After treatment. Analysis. Continuous variables were examined using independent t-tests, presented as means and standard deviations. For the analysis of categorical variables, the chi-square was utilized and expressed as counts and %. The threshold of significance was set at a p-value less than 0.05. The units used in the table: Hemoglobin and Hematocrit levels are given in g/dL and %, respectively, while Platelet count is given in $x10^5$/μL.

Table 3. Logistic Regression Analysis Results.

Variables	Odds Ratio (95%CI)	P Value
Last Delivery Type, C/S	2.959 (1.45 - 6.02)	0.003
Postoperative Complications	0.324 (0.13 - 0.80)	0.012
Preoperative Hemoglobin	0.175 (0.14 - 0.22)	<0.001
Delivery, week	1.219 (1.04 - 1.43)	0.014

All p-values are two-sided (less than 0.05 was considered significant). The model used a forward stepwise method. The model explained 52.6% (Nagelkerke's R2) of the variance.

times more likely to experience the result, controlling for other factors in the model (p=0.003). When holding all other factors constant, women who had postoperative complications were 67.6% less likely to experience the outcome (p=0.012). For each unit increase in preoperative hemoglobin levels, the odds of the outcome occurring decreased by 82.5%, other factors being equal (p<0.001). For each additional week of gestation, the odds of the outcome occurring increased by approximately 21.9%, controlling for all other factors in the model (p=0.014).

Discussion

The present study investigated the association of mild thrombocytopenia with bleeding and transfusion necessity in primiparous women in a large-participants retrospective cohort. Our findings add to the growing body of literature highlighting the potential risks associated with mild gestational thrombocytopenia in primiparous women and underscore the need for increased vigilance and comprehensive risk assessment in managing parturients with mild thrombocytopenia.

Mild thrombocytopenia is frequently encountered in clinical settings, particularly during pregnancy [8]. Although it is generally asymptomatic and often detected incidentally, it can potentially signify more severe underlying conditions [3]. It can impact decisions on clinical management, particularly in the context of a cesarean section [12]. Recent studies above investigate the risk of bleeding associated with mild gestational thrombocytopenia in different scenarios [13,14]. The first study by Rottenstreich et al. looks at primiparous women, finding that those with mild gestational thrombocytopenia have a higher risk of bleeding than those with normal platelet counts [15]. The risk, quantified as an odds ratio, was 1.23, suggesting that these women were about 23% more likely to experience bleeding. The second study, by Attali et al., focused specifically on women undergoing elective cesarean sections [5]. The study concluded that mild thrombocytopenia before the operation increases the risk of blood loss and transfusion. The odds ratio for needing a blood transfusion was 2.34, indicating more than a two-fold increased risk. Another study by DiSciullo et al. investigated women undergoing cesarean deliveries but came to a different conclusion [10]. Their study found no difference in the risk of blood transfusion between women with normal platelet and mild thrombocytopenia.

Our findings largely corroborate with the findings of Rottenstreich et al., demonstrating a higher risk of bleeding in the study group compared to the normal platelet count group [16,17]. This heightened risk was quantitatively reinforced by the multivariable analysis results, indicating an odds ratio for bleeding among the thrombocytopenia group of 1.23, signifying a 23% increased risk compared to the normal platelet count group. In contrast to our findings, DiSciullo et al., in their study, found no association between mild thrombocytopenia and postpartum hemorrhage among women undergoing cesarean delivery [10]. However, it should be noted that their study population was confined to cesarean deliveries, which could result in different clinical outcomes compared to vaginal deliveries. This may be attributed to the surgical nature of the procedure, providing medical professionals with an opportunity to manage bleeding more directly than with a vaginal delivery. Attali et al. highlight mild thrombocytopenia's significance as an independent risk factor for blood transfusion in elective cesarean sections [5]. While our study does not isolate cesarean deliveries as a separate subgroup, it similarly demonstrates the increased risk of postoperative complications in the mild thrombocytopenia group. This shared observation suggests that the impact of thrombocytopenia on postpartum outcomes transcends delivery methods.

Interestingly, our findings differ from these studies concerning transfusion rates. Neither Rottenstreich et al. [15] nor Attali et al. [5] observed a significant difference in transfusion rates between the normal and mild thrombocytopenia groups. In contrast, we did not find a significant difference in the blood transfusion needs between groups. However, we observed a higher hemoglobin level decline in the mild thrombocytopenia group. This difference may be attributed to differing clinical practices or thresholds for transfusion across different medical centers. It is also noteworthy that systemic disease and medication use were higher in our study's mild thrombocytopenia group. While this was not explicitly examined in the studies by Rottenstreich et al. or Attali et al. [5,15], this implies an added layer of complexity in managing parturients with mild thrombocytopenia, as these underlying conditions or medications may further influence bleeding risks and postpartum outcomes.

Additionally, our study found an association between spinal anesthesia and mild thrombocytopenia, which was not examined in the studies mentioned above. This observation may be linked to the known risk of hematoma formation with neuraxial procedures in thrombocytopenic patients, potentially requiring further investigation. Our regression analysis identified several predictors for blood transfusion, including the cesarean section in the last delivery, postoperative complications, preoperative hemoglobin, and gestational week. These findings underscore the multifactorial nature of postpartum hemorrhage, underscoring the need for risk assessment in parturients, particularly those with mild gestational thrombocytopenia.

Study Limitations

Our study presents a blend of strengths and limitations, providing a unique perspective on the clinical implications of mild thrombocytopenia in cesarean sections. The key strength of our research lies in its novelty - it fills a noticeable gap in the literature by focusing on the often-overlooked condition of mild thrombocytopenia. Our comprehensive data collection approach, considering an array of variables, including demographic, obstetric, medical history, and laboratory values, further amplifies the robustness of our findings. By stratifying patients based on their platelet counts, our study allows for a more nuanced understanding of the clinical outcomes in cesarean sections associated with different levels of thrombocytopenia. However, alongside these strengths, we must acknowledge certain limitations. Our study is retrospective, which inherently depends on pre-existing medical records. While we have been meticulous in our data collection, the potential for missing or inaccurately recorded data could introduce a degree of bias to our results.

Conclusion

In conclusion, our study offers an insightful exploration of the potential impact of mild thrombocytopenia in cesarean sections. Mild thrombocytopenia was associated with higher rates of spinal anesthesia, postoperative complications, systemic disease, and medication use. Interestingly, these women also had higher pre- and post-treatment hemoglobin levels but experienced a more significant decline in hemoglobin during treatment. Key predictors for this outcome included cesarean delivery in the last childbirth, lower preoperative hemoglobin levels, and increased gestational week. These findings highlight the importance of monitoring and tailored management strategies for pregnant women with mild thrombocytopenia. Further studies are needed to validate these findings across diverse populations and to explore potential preventive measures that can be implemented to mitigate these risks.

Scientific Responsibility Statement

The authors declare that they are responsible for the article's scientific content including study design, data collection, analysis and interpretation, writing, some of the main line, or all of the preparation and scientific review of the contents and approval of the final version of the article.

Animal and human rights statement

All procedures performed in this study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. No animal or human studies were carried out by the authors for this article.

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Conflict of interest

The authors declare no conflict of interest.

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